

NON-PUBLIC?: N
ACCESSION #: 9107160385
LICENSEE EVENT REPORT (LER)

FACILITY NAME: VERMONT YANKEE NUCLEAR POWER STATION PAGE: 1
OF 04

DOCKET NUMBER: 05000271

TITLE: Reactor Scram Due to Loss of 345KV Switchyard Caused by Defective
Off-Site Carrier Equipment

EVENT DATE: 06/15/91 LER #: 91-014-00 REPORT DATE: 07/15/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: DONALD A. REID, PLANT MANAGER TELEPHONE: (802) 257-7711

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: FK COMPONENT: TMRC MANUFACTURER: G080

REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 06/15/91 at 2224 hours, during normal operation with Reactor power at 100%, a Reactor Scram occurred due to a Turbine Control Valve Fast Closure on Generator Load Reject resulting from a loss of the 345KV North Switchyard Bus. The event was initiated during a thunderstorm in which a lightning strike occurred on the "B" phase of the 381 transmission line between Vermont Yankee and Northfield. The fault resulted in the opening of all 345KV Air Trip Breakers (ATBs). During the event, a subsequent Reactor Scram and corresponding Primary Containment Isolation Signals (PCIS)(*JM) Groups 2 and 3 were received due to Low Reactor Water level. The Reactor was stabilized in Hot Standby using the Main Condenser, Condensate, and Feedwater systems. At 2100 hours on 06/16/91, after Reactor depressurization was completed, Shutdown Cooling using the "D" RHR pump on the "B" loop was initiated. The reactor reached Cold Shutdown at 0500 hours on 06/17/91. The reactor

was returned to critical at 1413 hours on 06/20/91.

The Root Cause of this event is a defective (shorted) transistor in offsite (Scobie Pond) Protective Relaying System Carrier equipment. The need to perform additional testing of Carrier systems is being evaluated.

*Energy Information Identification System (EIIS) Component Identifier

END OF ABSTRACT

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DESCRIPTION OF EVENT

On 06/15/91 at 2224:22 hours, during normal operation with Reactor power at 100%, a Reactor scram occurred as a result of Turbine Control Valve Fast Closure on Generator Load Reject due to a loss of the 345KV North Switchyard Bus. The event was initiated during a thunderstorm in which a lightning strike occurred on the "B" phase of the 381 transmission line between Vermont Yankee and Northfield, Ma. The fault resulted in the opening of the 81-1T and 381 Air Trip Breakers (ATBs). An unanticipated trip of the 379 Scobie line on Carrier Overreach also occurred coincident with the fault resulting in trips of the 379 and 79-40 ATBs. The cumulative effect of the breaker openings left only the Coolidge (340) Line connected to Vermont Yankee. This line subsequently tripped on overload, opening the 1T ATB. With all 345KV ATBs open, all load paths for Vermont Yankee's output were shed which resulted in a Generator Load Reject and subsequent plant scram.

Following the Generator Load Reject and Turbine Control Valve Fast Closure, plant buses remained connected to the Main Generator via the Aux Transformer for approximately 30 seconds at which point the Turbine tripped from a "Lo" Scram Air Header Pressure Time Delayed Signal. During the first 10 seconds of this interval, plant buses experienced voltage oscillations while the Main Generator voltage output attempted to regulate during the transition from 100% to approximately 5% load. The voltage oscillations experienced resulted in the following major system responses:

- Primary Containment Isolation System (PCIS)(*JM) Groups 1A, 2A, 3A, 5A and 5B were received due to low 120VAC Instrument bus voltage resulting in the closure of Group 5 Isolation valves as required.
- "A" and "B" Station Air Compressors tripped due to low 120VAC Instrument bus voltage. Both air compressors were restarted at 2233 hours.

- Reactor Recirculation Units (RRUs) 2 and 4 Tripped due to dropout of a 120VAC Drywell Cooling and Control Room Air Conditioning Blocking relay from low voltage. Both RRUs were restarted at 2233 hours.

- "B" and "C" Reactor Feedwater Pumps Tripped on Low Suction Pressure resulting from transients in the Condensate System which were caused by the undervoltage conditions. Feed flow was restored within 10 seconds.

- "A" and "B" Recirc Pump Breakers opened due to Low Lube Oil Pressure. The loss of Lube Oil was a result of blown control circuit fuses.

- "A" and "B" Advanced Off Gas (AOG) Recombiners tripped due to low 120VAC Instrument bus voltage. This resulted in the blowout of a Steam Jet Air Ejector (SJAE) Rupture Disc.

In addition to the (low voltage) received PCIS signals, a decreasing 127 inch "LO" Reactor Water level was experienced 7 seconds into the event, at 2224:29 hours, generating a Reactor Scram and remaining PCIS Group 2B and 3B isolation signals resulting in the required Group 2 and 3 isolations. The water level reached a low of 122 inches and is attributed to void collapse from the initial Scram.

* Energy Information Identification System (EIIS) Component Identifier

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DESCRIPTION OF EVENT (cont'd)

Approximately 10 seconds into the event, at 2224:32 hours, the 381 ATB reclosed which reenergized the Auto Transformer. The 379 ATB reclosed 12 seconds later at 2224:44 hours. Coincident with the turbine trip at 2224:50 hours, a Generator Lockout was initiated which resulted in Fast Transfer of plant buses to the Startup Transformers. With reliable 115KV power available from the Auto Transformer, 4KV and 480V Bus voltages remained stable from this point on.

In response to the Scram, Operations personnel entered emergency Operating Procedure OE-3100 "Scram Procedure" which governs reactor operation in a post-scrum environment. Operators noted during the Scrams that approximately 25% of the Control Rods lacked "Full In" indication (the associated rod display was blank). Reactor power was verified to be less than 2%, by Average Power Range Monitor (APRM) downscale indication. This condition prompted the entry into Emergency Operating Procedure

OE-3101 "Reactor Pressure Vessel (RPV) Control Procedure" in which a Manual Scram was initiated at 2226 hours and subsequently reset at 2228 hours. Upon resetting of the Scram, all rods indicated "00" and OE-3101 was exited. The loss of indication for a portion of the Control Rods is attributed to a known phenomena called rod overtravel in which a loss of position indication can occur if a control rod inserts slightly past the full in position resulting in a misalignment of the corresponding position indication switches.

During the event, Reactor pressure and level were maintained using the Main Condenser, Condensate, and Feedwater systems. At 2100 hours on 06/16/91, Shutdown Cooling was initiated using the "D" RHR pump on the "B" loop. The reactor reached Cold Shutdown at 0500 hours on 06/17/91. The reactor was returned to critical at 1413 hours on 06/20/91.

CAUSE OF EVENT

The Root Cause of this event is a defective (shorted) transistor in offsite (Scobie Pond) Protective Relaying System Carrier equipment. The lightning strike which occurred on the "B" phase of the 381 Transmission line between VY and Northfield, Ma. would normally have only resulted in an isolation of the 381 line. However, the defective component in the Scobie Pond Carrier equipment caused a subsequent loss of the 379 line. This routed the full Generator output through the 340 (Coolidge) line. The Coolidge line cannot handle full generator output and tripped out on overload which resulted in a loss of the 345KV yard and caused the Reactor to Scram on Generator Load Reject.

After the plant Scram, an extensive testing and troubleshooting effort was performed by Vermont Yankee and New England Power Service Co. (NEPSCO) to determine the cause of the Scobie Line Carrier trip. It was found that the the equipment on the VY end operated as designed and sent a Carrier block signal to Scobie to prevent tripping. Although the signal was received at Scobie Pond, the trip signal was not blocked. A failed transistor in the Carrier equipment logic section prevented the blocking signal from reaching the tripping logic. Since the tripping logic did not see a blocking signal it caused the Scobie line to trip at Scobie Pond and Vermont Yankee.

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CONTRIBUTING CAUSES

1. Lightning strike on the B phase of the Northfield line was the contributing cause to the event.

ANALYSIS OF EVENT

The events had minimal adverse safety implications.

1. The Reactor Protective System operated as designed and scrambled the reactor on Generator Load Reject resulting from the loss of 345KV power.
2. Fast transfer to an off-site source occurred as designed upon receipt of a Generator Lockout.
3. All other safety systems responded as expected.

CORRECTIVE ACTIONS

SHORT TERM CORRECTIVE ACTIONS

Immediate corrective actions included recovering from the reactor scrams, troubleshooting and repair of the Scobie Pond equipment, and reactor stabilization utilizing appropriate plant procedures.

LONG TERM CORRECTIVE ACTIONS

VY Maintenance Department and VELCO Switchyard Engineers will evaluate testing requirements for Switchyard Carrier systems.

The above Long Term Corrective Action will be completed by 11/01/91.

ADDITIONAL INFORMATION

There have been no similar events of this type reported to the commission in the past five years.

ATTACHMENTS

SKETCH: Switchyard Distribution

ATTACHMENT 1 TO 9107160385 PAGE 1 OF 2

Figure "Switchyard Distribution" omitted.

ATTACHMENT 1 TO 9107160385 PAGE 2 OF 2

VERMONT YANKEE
NUCLEAR POWER CORPORATION

P.O. Box 157, Governor Hunt Road
Vernon, Vermont 05354-0157
(802) 257-7711

July 11, 1991
VYV # 91-148

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

REFERENCE: Operating License DPR-28
Docket No. 50-271
Reportable Occurrence No. LER 91-14

Dear Sirs:

As defined by 10 CFR 50.73, we are reporting the attached Reportable Occurrence as LER 91-14.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Donald A. Reid
Plant Manager

cc: Regional Administrator
USNRC
Region I
475 Allendale Road
King of Prussia, PA 19406

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